



Intraoperative Left Mammalian Artery Flow Measurement in Elderly Patients

Yaşlı Hastalarda Operasyon Sırasında Sol Mammalian Arter Akımının Ölçülmesi

Mammalian Artery Flow

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Özet

Amaç: Batı toplumlarında yaşlı nüfus giderek artmakta olup, bununla bağlantılı olarak koroner bypass cerrahisine refere edilen yaşlı nüfusta artmaktadır. Koroner bypass cerrahisinde bu hasta grubunda LİMA kullanımının daha iyi erken dönem patensi sağlamakta ve hayatta kalımı artırmaktadır. Bu çalışmada LİMA'nın kan akımı 75 yaş üstü hasta grubunda diğer tüm komponentlerden bağımsız olarak ölçülerek diğer yaş gruplarıyla karşılaştırılması yapılarak bu gruplarla anlamlı fark olup olmadığı ortaya çıkarılmaya çalışıldı. Gereç ve Yöntem: 2010 Martından 2013 Kasımı arasında 84 hastaya primer CABG ameliyatı yapıldı. Tek merkezli yapılan bu çalışma, prospektif, randomize analizidir. Hastalar üç gruba ayrıldı: Grup I: 60≤ yaş, Grup II: 60-75 yaş ve Grup III: üstü ≥75 yaş. Lima kan akımını daha detaylı karşılaştırabilmek için hastalar ayrıca alt gruplara da ayrıldı: atletik aktivitelerle uğraşanlar, diyabetikler, non-diyabetikler, ve erkek-kadın gibi. Bulgular: Gruplara ait LİMA kan akımları şu şekilde ölçüldü: Grup I: 83.7 ± 12.4 ml / dk, Grup II: 79.5 ± 13.4 ml / dk ve Grup III: 78.6 ± 10.6 ml / dk (P≤0.76) Tartışma: LİMA kan akım hızı diğer tüm değişkenlerden bağımsız olarak değerlendirildi. LİMA kan akım hızı açısından değerlendirildiğinde, yaşlı hastalar ve diğer hasta grupları arasında istatistiksel olarak anlamlı bir fark yoktu.

Anahtar Kelimeler

Kan Akım Hızı; Mammalian Arter; Koroner Arter Bypass; Geriyatrik Hasta

Abstract

Aim: The elderly are a continuously growing subgroup in Western society. Therefore, increasing numbers of elderly patients are being referred for coronary artery bypass grafting (CABG) surgery. The left internal mammary artery (LIMA) grafting technique performed during CABG surgery has been shown to result in better early patency and improved survival rate. In the present study, the LIMA blood flow was measured independently from other components in a group of patients above 75 years of age. Additionally, we examined if there was significant difference between the LIMA blood flow rate of this and other age groups. Material and Method: Between March 2010 and November 2013, primary CABG was performed in 84 consecutive patients. Patients were divided into three groups as follows: Group I, 60≤ years; Group II, 60-75 years; Group III, ≥75 years. For the comparison of LIMA blood flow rates, the patients were further divided into subgroups as those who were actively engaged in athletic activities, diabetics, non-diabetics, males, and females. Results: The LIMA blood flow rate measured in the three groups had the following values: Group I, 83.7 ± 12.4 mL/min; Group II, 79.5 ± 13.4 mL/min; Group III, 78.6 ± 10.6 mL/min (P≤0.76). Mean blood flow was 84.6 ± 14.8 mL/min in males, 76.8 ± 9.4 mL/min (P≤0.05) in females, 76.4 ± 12.4 mL/min in diabetics, 86.6 ± 12.8 mL/min (P≤0.05) in non-diabetics, 88.6 ± 14.2 mL/min in patients actively engaged in athletic activities, and 78.3 ± 11.3 mL/min (P≤0.05) in patients who were not engaged in athletic activities. Discussion: There was no statistically significant difference between the LIMA blood flow rates of elderly patients and that of other patient groups. Therefore, arterial grafting could be widely used in elderly patients.

Keywords

Flow; Arterial; Grafts; Elderly; Patients; Coronary; Bypass; Surgery

DOI: 10.4328/JCAM.3889

Received: 16.09.2015 Accepted: 01.10.2015 Printed: 01.11.2016 J Clin Anal Med 2016;7(6): 795-8

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Introduction

A number of studies have found better long-term patency and survival rates in patients undergoing coronary artery bypass grafting (CABG), in which a left internal mammary artery (LIMA) is grafted to bypass the left anterior descending artery (LAD) [1–3]. The use of the LIMA to bypass the LAD has become the standard of care in CABG. The advantages of LIMA grafts over saphenous vein grafts (SVGs) include better graft patency [4], fewer subsequent adverse cardiac events [5, 6], fewer subsequent revascularization interventions, and enhanced survival rates [7–8]. As the elderly subgroup of population continues to grow in Western society, increasing number of elderly patients are being referred for CABG surgery. The use of the LIMA for CABG in these patients has resulted in better early patency and improved survival [9]. Arterial grafting may be deemed inappropriate for elderly patients due to the higher prevalence of peripheral artery disease, chronic obstructive pulmonary disease (COPD), diabetes, and renal disorders. In the present study, LIMA blood flow rate was measured independently from all other components in a group of patients over the age of 75 years, and an analysis was performed to determine if there was significant difference between the LIMA blood flow rates of this and other age groups.

Material and Method

Between March 2010 and November 2013, primary CABG was performed in 84 consecutive patients. The present study was a single-center, prospective, randomized analysis. The patients were divided into three groups as follows: Group I, 60≤ years; Group II, 60–75 years; Group III, ≥75 years. For the comparison of LIMA blood flow rates, the patients were further divided into subgroups as those who were actively engaged in athletic activities, diabetics, non-diabetics, as well as males and females. Patients who underwent isolated CABG surgery were included in the study. Exclusion criteria for the study were as follows: emergency operations, concomitant procedures other than coronary surgery, left ventricular (LV) ejection fraction less than 20%, Euro score greater than 10, peripheral arterial disease, redo cases, patients who underwent radiotherapy and/or chemotherapy, injured LIMA, and patients who did not provide informed consent to participate in the study. As shown in Table I, patient demographics, severity of disease, and clinical outcomes for the three groups were similar. The study was approved by the Local Ethics Committee. Informed consent was obtained from the patients.

Technique used for Harvesting the LIMA

The LIMA from the first rib to the IMA bifurcation was harvested from all patients. The endothoracic fascia was incised longitudinally and laterally to the medial satellite vein using bipolar electrocautery at a low setting (level 3 out of 10) (KLS Martin MEMB1, Gebrüder Martin, Tuttlingen, Germany). The space between the medial satellite vein and the internal thoracic artery (ITA) was carefully dissected by the respective instrument's blade, exposing the lateral branches. Proximally, the artery branches were ligated with vascular clips. Distally, lateral tributaries with a diameter of 3 mm were clipped and divided by surgical scissors. After systemic heparinization, the

Table I. characteristics of patients

	Group 1	group 2	group 3	p
Patients	(n=32)	(n=36)	(n=20)	
Male/female	27 (85%)/ 5 (15%)	24 (68%)/ 12 (32%)	12(60%)/ 8(40%)	0.036
DM	9 (30.3%)	13 (36.3%)	8(40%)	0.013
Hypertension	17 (53.1 %)	20 (55.5 %)	12(60%)	0.77
HLP	27 (84.5%)	28 (86%)	17(86.5%)	0.799
Renal failure*	2 (5.6%)	3 (5.8%)	1 (5%)	0.34
Chronic obstructive lung disease	3 (8.8 (%))	3 (9 %)	2(10%)	0.49
Previous myocardial infarction	11 (34%)	2 4 (66,2%)	14(70%)	0.021
Unstable angina preoperatively	12 (37.5%)	19 (52.1%)	11(55%)	0.194
LVEF	(%) 50.4±12.2	48.8±13.5	45.4±7.6	0.66
Left main disease	5 (16 %)	7 (19.4%)	4(20%)	0.54
Triple-vessel disease	17(53%)	18 (50%)	10(50%)	0.85
Double-vessel disease	5(16%)	8(23.6%)	4(20%)	0.84
Single-vessel disease	5(16%)	3(7%)	2(10%)	0.15
Atrial fibrillation	4(5.2%)	4(11.1%)	3(15%)	0.015
Smoking	13 (40,3%)	14(38,5%)	7(35%)	0.084
Alcohol use	3 (9,6%)	3 (8,3%)	1(5%)	0.671
BMI	24,2	26,1	23.4	0.565

DM: diabetes mellitus; HLP: hyperlipoproteinemia; BMI: body mass index;

Continuous variables presented as mean ± SD.

* Blood creatinine > 1.5 mg/dl

LVEF = left ventricular ejection fraction

Table 2. Hemodynamic data and temperature

Patients	Group 1	Group 2	Group 3	p
	(n=32)	(n=36)	(n=30)	
HR (beat/min)	74.4±4.1	76.7±10.8	68.5±3.5	p < 0.001
MAP (mmHg)	75.6±9.1	83.1±5.7	78±2.7	p < 0.001
CVP (mmHg)	6.7±3.5	8.3±1.9	9.1±2.1	p < 0.001
Temperature (OC)	35.6±0.6	35.7±0.4	35.8±0.6	0.145

Continuous variables presented as mean ± SD.

HR; heart rate; MAP; mean arterial pressure; CVP; central venous pressure

distal end of the IMA was divided and prepared for 7-0 polypropylene suture anastomosis. In all patients, papaverine solution (60 mg papaverine in 50 mL normal saline) was injected into the IMA. After the preparation of the left internal mammary artery (LIMA), routine surgical preparation continued. After the completion of cannulation and immediately before initiating the on-pump procedure, the blood flow in the LIMA was tested by bleeding the vessel into a graduated tube for 1 min. Routine surgical procedures then continued. Throughout the course of the procedure, systolic arterial pressure was maintained between 100 and 130 mmHg, and diastolic arterial pressure was maintained between 50 and 70 mmHg.

Statistical Analysis

Statistical analyses were performed using the SPSS statistical software, version 11. Continuous variables were expressed as mean ± SD. Differences between continuous variables were assessed with the help of student's t-test. Categorical variables were compared using the paired test or Fisher's exact probability test. Significance was established as P<0.05. Bivariate correlations were made with the help of the bivariate correlation

test. The data from three independent groups were compared using Fisher's exact probability test.

Results

Of the patients, 35.8% (30/84) were diabetic, 54 were non-diabetic, 16 subjects were engaged in athletic activities, and 25 subjects were females (29.8%). No significant difference was found between the LIMA blood flow rates of different groups. The LIMA blood flow rates measured in the three groups had the following values: Group I, 83.7 ± 12.4 mL/min; Group II, 79.5 ± 13.4 mL/min; Group III, 78.6 ± 10.6 mL/min ($P \leq 0.76$) (Figure 1). The mean blood flow rate was 84.6 ± 14.8 mL/min in males, 76.8 ± 9.4 mL/min ($P \leq 0.05$) in females, 76.4 ± 12.4 mL/min in diabetics, 86.6 ± 12.8 mL/min ($P \leq 0.05$) in non-diabetics, 88.6 ± 14.2 mL/min in patients actively engaged in athletic activities, and 78.3 ± 11.3 mL/min ($P \leq 0.05$) in patients who were not engaged in athletic activities.

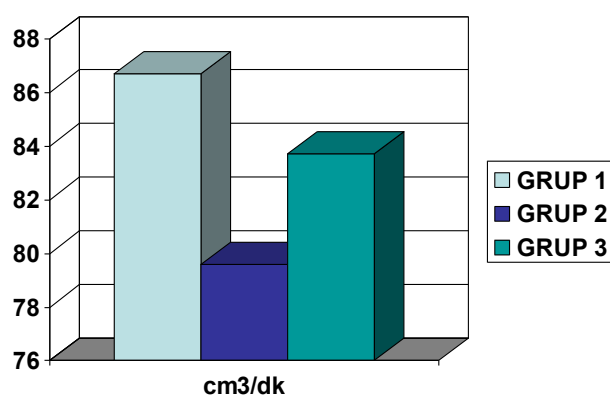


Figure 1. Age groups and LIMA flow values

Discussion

The utilization of an IMA in CABG has reduced operative mortality without increasing the surgical complications [1, 2]. Compared to SVGs, IMA grafts to the LAD has been proven to result in superior long-term patency rate [3] and reduced long-term morbidity and mortality in patients with coronary artery disease [4–8]. In patients with severe coronary artery disease, CABG surgery is recommended to re-establish adequate blood supply to the ischemic myocardium [10, 11]. Compared to medical management, CABG offers reduced morbidity and mortality in patients with left main, triple-vessel disease and/or proximal stenosis of the LAD [11–13], and lowers coronary repeat revascularization rate in comparison to percutaneous coronary intervention [2, 14]. Advances in medical therapy for ischemic heart disease and heart failure have improved the outcomes of patients with coronary artery disease. The survival advantage of CABG surgery over medical management in patients with stable angina has been challenged [15], and is the subject of the ongoing ISCHEMIA Trial [14]. The effectiveness of CABG surgery is directly related to graft patency [2, 16].

With the age of the patients undergoing coronary artery bypass surgery steadily advancing, there is an urgent need for thoroughly evaluating the impact of surgical innovations (such as total arterial myocardial revascularization) in this high-risk sub-

set of patients. However, despite recent studies demonstrating the beneficial effects of total arterial grafting in the younger population [17–18], most surgeons still consider SVGs as the conduits of choice for myocardial revascularization in elderly patients. This is because of the belief that arterial grafting in elderly patients may be associated with a higher perioperative morbidity and mortality when compared with younger patients [19].

The rate of LIMA usage is also likely to be of significance to healthcare providers. Patients who receive LIMA to LAD as a part of coronary revascularization procedure are likely to require fewer interventions and experience fewer morbid events in the long term [1, 2]. This is likely to have a significant impact on the distribution and utilization of resources and manpower. LIMA utilization across UK has varied from 75% to 80%. Over a 6-year period starting from April 1997, LIMA usage in the four cardiac centers in Northwest England increased from 83.9% to 89%. In these centers, LIMA usage typically varied between 77.4% and 89.9%, with surgeon's choice of LIMA varying from 61% to 97% [20].

In the present study, the LIMA blood flow rate was evaluated independently from all other variables. There was no statistically significant difference between the LIMA blood flow rate of elderly patients and that of other patient groups. Our results suggest that arterial grafting should not be abandoned solely based on the advanced age of the patient and that LIMA may be used in all age groups. We also found that patients engaged in athletic activities had significantly higher blood flow rates in LIMA. Notably, patients who had a military profession showed particularly higher LIMA blood flow rate, likely related to their lifelong athletic activities.

The LIMA blood flow rate was lower in women, which might be a factor contributing to the higher surgical risk in women undergoing coronary artery bypass grafting. Our detailed analysis showed that blood flow in the arterial grafts is lower in diabetic patients. This could be due the fact that diabetes mostly affects the medium- and small-sized arterioles.

In conclusion, we found that LIMA blood flow rate is not affected by age. It is a common notion that arterial grafts are excellent conduits in coronary artery bypass grafting. The present results showed that this is also applicable to elderly patients. Therefore, arterial grafting could be widely used in elderly patients.

Funding

'This work was not supported by any funding'

Competing interests

The authors declare that they have no competing interests.

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How to cite this article:

Yasa H, Ozcem B, Akyuz M, Işık O. Intraoperative Left Mamarian Artery Flow Measurement in Elderly Patients. *J Clin Anal Med* 2016;7(6): 795-8.